DISTRIBUTION AND ABUNDANCE OF JUVENILE COHO AND STEELHEAD IN SCOTT AND WADDELL CREEKS IN 1988 AND 1994: IMPLICATIONS FOR STATUS OF SOUTHERN COHO.

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ABSTRACT: In July and August 1994 mostly previously sampled representative sites on Waddell Creek and in the Scott Creek watershed were sampled by electroshocker to assess distribution and abundance of 1994 year class coho. Previous data from electroshock sampling of both streams in 1988 were also analyzed for comparison. On Scott Creek the 1988 coho year class was quite strong, with coho at 12 of 14 sites and a mean density of 15.5 coho per 100 feet of sampled habitat. However, coho declined by 1994, 2 cycles later, to presence at only 6 of 13 sites and a mean density of only 1.1 coho per 100 feet. The decline apparently occurred due to poor adult access in the winter of 1990-91; the 1991 year class was also apparently very weak. In 1988 coho were collected at 5 of 8 sites on Waddell Creek, but were common at only 1 site. Only 19 coho were collected in 1988, compared to 784 steelhead, and coho density in sampled habitats, which were biased towards pools, was only 1.3 coho per 100 feet. No coho were collected from 12 Waddell Creek sites in 1994, despite intensive sampling of their preferred pool habitat. Since coho females are three year olds, the weak 1988 year class apparently resulted in the loss of coho one cycle (1991) or two cycles (1994) later. A dominant factor in the decline of coho in Waddell and Scott creeks, and possibly for many of the small streams in California, appears to be stochastic events (floods and droughts) which weaken or eliminate individual year classes. Since coho females are almost always 3 year olds, weakened year classes have a poor chance of recovery and extirpation is likely, even if spawning and rearing habitat are sufficient to support a viable coho population. Since 1988, one year class (1991, 1994, ...) on Scott Creek has been severely reduced, and the same year class on Waddell Creek has apparently been lost, due to drought impacts. Past impacts to the year class may be widespread, as the 1994 year class is also very weak 70 miles away in Redwood Creek in Marin County. The 1992 year classes on Scott and Waddell creeks were also apparently seriously reduced by a February flood. At the present time only 2 out of 3 coho year classes (1992, 1993) in Scott Creek appear viable, and most of the 1992 year class coho smolts were hatchery-reared. For Waddell Creek one year class (1994) is apparently gone and only one (1993), hatchery-augmented, year class remains viable. Maintenance and restoration of coho populations will require rebuilding weak or lost year classes, through transplants and/or hatcheries, not just through habitat conservation and restoration.

INTRODUCTION

Native, wild coho (Oncorhynchus kisutch) are rare south of San Francisco, with Waddell and Scott creeks in Santa Cruz County and Gazos Creek in San Mateo County having the only recently confirmed populations. Since all female southern coho spend one year in the stream

and two years in the ocean (Shapovalov and Taft 1954), three consecutive years of study are necessary to determine the status of the three numerically independent year classes. Smolt trapping on Waddell Creek during the later half of the spring migration period in 1992 collected no 1991 year class coho smolts (Smith 1992a), so that year class was very weak or possibly extirpated. Summer electroshock sampling in 1992 (Smith 1992b) collected only 19 juvenile coho, while sampling about 9 percent of Waddell Creek's potential coho habitat. In addition, only 119 coho smolts were collected during the second half of the downmigration period in 1993 (Smith 1993), so a second Waddell Creek year class was also very weak. Electroshock sampling in July through December 1993 (Davis and Smith 1993) collected more fish than in 1992, but the results confirmed a third weak year class.

On Scott Creek poor access in the winter of 1990-91 apparently resulted in a very weak 1991 year class. Smolt trapping by the Department of Fish and Game collected only 10 coho (versus 632 steelhead) during part of the spring 1992 migration period (Nelson 1993); few adults were likely in winter 1993-94. In 1992 an early February flood probably destroyed many coho redds, and electroshock sampling in late summer at 13 sites collected only 42 coho (Smith 1993). Most of the coho were at 3 sites within 0.4 miles; wild fish of the 1992 year class probably numbered fewer than 1000. A single Scott Creek female was
spawned at the Big Creek restoration hatchery (Monterey Bay Salmon and Trout Project), and 1800 smolts were released in 1993 (Dave Streig, MBSTP, personal communication). The most encouraging result of recent sampling was that coho of the 1993 Scott Creek year class were found to be abundant in January 1994 (Smith 1994a). They occurred at all sampled sites and outnumbered steelhead at 4 of the 11 sampled sites.

To gather distribution and abundance data on steelhead (O. mykiss) and on the 1994 coho year classes in Scott and Waddell creeks, I sampled the two streams in July and August 1994. I also analyzed sampling results from the two streams from 1988 and report those here for comparison.

METHODS

In July 1994 twelve sites on Waddell Creek were sampled, covering all but one site where coho had been collected in 1992 or 1993. In 1988 eight sites on Waddell Creek were sampled, and all were resampled in 1994. In August 1994 thirteen Scott Creek watershed sites were sampled; 10 were in common with each of the 1992 and January 1994 sampling efforts, but the August 1994 sites gave the most uniform sampling of the creek. In 1988 fourteen Scott Creek sites were sampled, and 7 of those sites were resampled during the 1992-1994 sampling; most of the others were near recently sampled sites. At resampled sites on both streams most of the same sampling stations were resampled.

The primary goal of the sampling was to look for the presence of coho, so sampling was concentrated in pool and glide habitats. At each site, usually three to five individual habitat "units" (a glide or pool, with its contiguous glide and run habitat) were sampled by 2 to 3 passes with a backpack electroshocker (Smith- Root Type 7, smooth pulse). Length, width, depth, cover (escape and overhead), and substrate conditions were determined, and percentage of

habitat type assigned for each habitat unit. Channel type was determined, and relative abundance of pool, glide, run and riffle habitat types was also estimated for the site.

Fish were measured (standard length) in 5 mm increments, and young-of-year steelhead were separated from older fish, based upon length-frequency at each site. Holdover hatchery steelhead were recognized by fin clips and/or worn, short dorsal fins.

RESULTS

Pool habitats were sampled in approximately twice their estimated abundance in both Scott and Waddell creeks in 1994 (Tables 2 and 4), and riffle and run habitats were rarely sampled. In 1988 sampling more nearly approximated available habitat overall, but was not necessarily representative at each site (Tables 1 and 3).

In 1988 on Waddell Creek, coho were collected at 5 of 8 sample sites (Table 1), but only single fish were collected at 3 of the sites. Only 19 coho were collected, compared to 674 young-of-year steelhead and 107 yearling or older steelhead. The mean of estimated site coho densities was only 1.3 fish per 100 feet (Tables 1 and 5). Coho were collected at the two sites on the West Fork and at Camp Herbert, immediately downstream of the West Fork. None were collected on the East Fork or at a site 0.5 miles downstream of Camp Herbert. Highest estimated coho density was at Twin Redwoods Camp, with about 6 fish per 100 feet, but only 1 coho was collected downstream of that site.

In 1994 no wild coho were collected at the 12 sites sampled on Waddell Creek, despite concentrating two-thirds of the effort on pools and spacing the sampling sites no more than 0.8 miles apart (Table 2). A single holdover hatchery-origin coho was captured at the most downstream site. Steelhead were slightly more abundant than in 1988, and the proportion of yearlings was more than twice that of 1988 (Tables 1 and 2).

In 1988 on Scott Creek coho were collected at 12 of 14 sites (Table 3), and the mean of estimated site coho densities was 15.5 fish per 100 feet. Eighty-five percent (337 of 384) of the coho collected came from the five sites between Little Creek and mile 4.9 on upper Scott Creek. No coho were collected upstream of the Big Creek hatchery or at the lowermost site on Mill Creek. Streamflows were extremely low by August in 1988, with sites on Mill Creek and those on Scott Creek, upstream of Big Creek, having flows of less than 0.02 cfs. However, the highest coho density was at the site at mile 4.9, where only isolated pools and deeper glides were left by August. Steelhead outnumbered coho in the collections by more than 5 to 1 (2087 to 384), but estimated coho density was twice that of yearling steelhead, which had similar habitat preferences (Table 3).

In 1994 coho were collected at only 6 of 13 Scott Creek sites, and were uncommon even at sites where they occurred (Table 4). Coho were captured at 4 sites on upper Scott Creek (miles 4.9 to 6.3) and at sites immediately downstream of Little Creek and upstream of Big Creek (miles 1.9 to 2.55); none were collected at the three sites spaced between miles 2.55 and 4.9. Only

17 coho were captured, and mean of sites densities for coho was only 1.1 fish per 100 feet of sampled habitat (Table 4). Overall estimated steelhead density in 1994 was similar to that of 1988 (70 versus 64 per 100 feet), but the density of yearling steelhead was more than twice that of 1988 (18 versus 7 per 100 feet) (Tables 3 and 4). At the Big Creek site several of the older steelhead were holdover hatchery-origin fish, but no hatchery-origin fish were captured at the two Scott Creek sites downstream of Big Creek.

DISCUSSION

Scott Creek

Coho were collected on Scott Creek at 12 of 14 sites in 1988 and at all 11 sites sampled in January 1994 (Smith 1994a). Densities were relatively high with 15.5 coho per 100 feet of sampled habitat in 1988 and 27.2 coho per 100 feet of sampled habitat in January 1994 (1993 year class) (Table 5). The actual stream densities during the two periods were probably roughly similar, as sampling in 1988 approximated available habitat, but in January 1994 the pools preferred by coho were sampled at about twice their relative abundance (Tables 1 and 2). The results from those two years demonstrate that spawning and rearing habitat on Scott is capable of supporting significant densities of coho. However, those densities are still substantially below those observed in Redwood Creek, Marin County in 1992 and 1993 (Table 5 and Smith 1994b).

Even when coho were relatively abundant in the Scott Creek watershed, most of the fish were at sites on Scott Creek between Little Creek (mile 1.9) and mile 5.85 (Table 3 and Smith 1994a), These sites were mostly in C3 channels, and rootwad and log pools were common. Coho were less abundant in Scott Creek downstream of Little Creek and in the steeper upstream section. They were also relatively scarce in Big Creek and Mill Creek. Pools are less abundant (Table 4), and good spawning substrate is very scarce downstream of Big Creek, so spawning success may limit coho use of the lower 2 miles of Scott Creek. In January 1994 coho were collected in the steeper, rockier upstream site on Scott Creek (Smith 1994a), and were observed upstream to the falls (D. Streig, pers. comm.). However, deep pools with woody cover were scarce at upstream sites, so the contribution to total coho abundance is relatively minor, even when some coho use steeper habitat. Big Creek has a high proportion of run and riffle habitat, and most pools (boulder and bedrock) have limited escape cover, limiting coho abundance. Good spawning substrate is also relatively rare in Big Creek. Mill Creek has numerous pools. However, the stream is small and most pools are shallow. Summer flows in Mill Creek are also quite low; in 1988 much of the channel lacked surface flow.

The decline in Scott Creek coho year class strength from 1988 to 1994 apparently occurred in 1991. In the winter of 1990-91 the sandbar at the mouth of Scott Creek did not open until after the first week in March, substantially later than most coho migrate and spawn (Shapovalov and Taft 1954). The weak 1991 coho year class is reflected in the very low numbers of coho smolts (10) trapped during part of the spring 1992 migration period (Nelson 1993). A weak 1994 coho year class was the best that could be expected. The low densities of coho collected at two separated clusters of sites (miles 1.9 to 2.55 and 4.9 to 6.3) in August 1994 suggest that at least

two pairs of successful spawners, but are also consistent with as few as two pairs.

The weak 1992 coho year class may reflect conditions during winter 1991-92, or might reflect residual effects of earlier bad years. A major storm in the second week of February was large enough to have damaged most coho redds in place at the time of the storm. A similar storm in February 1986, two 3-year cycles earlier, could have had similar effects. The weak 1992 year class could even reflect the impacts of the severe 1977 drought year.

Waddell Creek

Unlike Scott Creek, coho abundance in Waddell Creek in 1988 was low (Tables 1 and 5). Since adult access is easier on Waddell Creek than on Scott Creek, and since there were no destructive storms in the winter of 1987-88, the low coho abundance in 1988 apparently represents residual effects of previous droughts or floods. Two 3-year cycles earlier, in 1982, the severe January 4th storm would have destroyed early coho redds and could also have severely impacted stream spawning habitat for much of the winter. Waddell Creek appears to be much more subject to flood damage than is Scott Creek. In 1984 severe damage to riparian habitat on Waddell and East Waddell creeks, apparently from January 1982, was still in evidence; no damage was noted in Scott Creek. The weak 1988 year class might also be due to the 1976- 1977 drought; low streamflows, and the large diversion near the mouth of the creek, could have resulted in low numbers in summer of 1976 and also greatly restricted smolt outmigration in spring of 1977.

Low coho numbers in 1988, possibly combined with poor adult access in the winter of 1990-91, apparently eliminated subsequent year classes (1991 and 1994). In spring of 1992 no coho smolts were captured during downmigrant trapping, although efficient trapping was not begun until April 21st (Smith 1992a). In addition, coho were not captured during spring stream electroshocking or seining in the lagoon (Smith 1992a). In 1994 no coho were captured in July at 12 electroshocking sites. The sampling might have missed coho if numbers were small and the fish highly localized, but that is unlikely; even when coho densities on Scott and Waddell creeks were low in other years, coho were still found at a relatively high percentage of sampled sites (Table 5).

As on Scott Creek, the weak 1992 Waddell Creek coho year class may reflect 1991-92 winter conditions and/or previous impacts, such as the February 1986 flood and the 1977 drought. Based upon date of construction and nearness to paired adults or to carcasses, seven likely coho redds were identified on Waddell Creek prior to the February 1992 storm. All seven were destroyed by more than 0.4 meters of scour or fill during the storm. Hatching of eggs deposited prior to the storm was unlikely, and the majority of coho probably spawned prior to the storm (Shapovalov and Taft 1954).

In 1993 Waddell Creek coho were more abundant in sampled habitats, despite sampling habitats in proportion to availability, rather than preferentially sampling pools (Table 5 and Smith and Davis 1993). In 1993 they also occurred in Henry Creek and upstream on the East Fork Waddell Creek (Smith and Davis 1993). However, only one fish was captured downstream of mile 2.2, despite apparently suitable rearing habitat. As on Scott Creek, spawning habitat for

coho appears to be limited on lower Waddell Creek.

MANAGEMENT IMPLICATIONS

Since 1988, the 1991 and 1994 year classes have apparently been lost from Waddell Creek, and the same year class on Scott Creek have been extremely weak. The 1992 Waddell Creek and Scott Creek year classes were also extremely weak, at least partially due to the February 1992 storm. Stochastic events in past years, and the drought and flood impacts documented since 1988, have been a major factor in the decline of Waddell and Scott Creek coho populations. Similar impacts may be a major factor in the general decline of coho, as a very weak year class was also found in 1994 in Redwood Creek, 70 miles to the north in Marin County (Table 5 and Smith 1994b).

The densities of coho found in Waddell Creek in 1992 and Scott Creek in 1992 and 1994 are similar to the Waddell Creek density of 1988 (Table 5). The low 1988 density, possibly combined with poor access in 1990-91, resulted in the loss of the year class in 1991 and 1994. The weak year classes are similarly at extreme risk of extirpation. Wild coho production on Scott Creek in 1992 was augmented by 1800 hatchery-reared smolts (D. Streig, pers. comm.), so the risk of the loss of that year class, due to low numbers, is reduced. However, most of the adults returning to Scott Creek in winter 1994-95 will be of hatchery origin, from a single female.

The 1993 year class on Scott Creek was strong, the 1993 Waddell Creek year class was augmented by Scott Creek smolts, and in 1993 coho were also present on Gazos Creek (Table 5 and Smith 1994a). At the present time, that year class may represent the only secure portion of the coho stocks south of San Francisco. However, since wild southern coho females are invariably three- year olds (Shapovalov and Taft 1954), the strong year class can only be used to bolster weak ones if 2 or 4 year old females can be manipulatively produced.

Augmenting weak year classes, or restoring lost year classes, by transplants may be difficult. The 1994 year class was the weakest one in Scott and Waddell creeks, but was also very weak in Redwood Creek (Table 5). Redwood Creek did have high coho densities in 1992 (Table 5), and could serve as a source for bolstering the 1995 year class on Scott and Waddell creeks.

A management plan should be developed, and Coastal Commission and Army Corps of Engineers permits secured, to allow for the artificial breaching of the sandbar at Scott Creek lagoon if natural breaching does not occur by January 21st. Poor adult access would be of special concern in the winters of 1994-5 and 1996-7, when weak year classes will be returning.

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Table 1. Site locations, habitat types present (1994) and sampled, number of steelhead and coho collected and estimated density per 100 feet () at sites on Waddell Creek in June-August 1988. (Pl=pool; GL=glide; RN=run; RF=riffle)

Site	Mile >Hwy1	Chan Type	%Hab Avail PL	GL	RN	RF	%Hab Sampl PL	GL	RN	RF	Sample Length	#SHT 0+	#SHT 1+	COHO
1 <>Div	0.5	C3	33	45	15	7	39	24	30	7	494′	179 (57)	30 (10)	1 (0.2)
2 <Alder Camp	1.35	C3	30	50	10	10	32	40	28	-	229	82 (40)	19 (8)	-
3 Twin Redwoods	1.8	C3	30	55	10	5	65	35	-	-	226	44 (21)	7 (7)	13 (6)
5 Pullout <Herbert	2.6	C1	40	26	20	14	61	-	39	-	105	35 (42)	8 (8)	-
6 Camp Herbert	3.1	C1	30	35	25	10	67	-	33	-	105	39 (38)	15 (15)	3 (3)
7 E Fork > Ford	3.2	C1	25	40	20	15	70	-	18	12	115	35 (33)	9 (8)	-
West Fork														
9 Mill Site	3.9	C3	45	30	15	10	52	12	36	-	169	50 (34)	4 (3)	1 (1)
10 Trib @ Bridge	4.7-5.1	C1 C1-1	35	35	20	10	53	21	13	13	374	210 (90)	16 (5)	1 (0.3)
Slippery Falls	5.35													
Totals											1817′	674 781	107	19
Mean of 8 Sites			33	41	16	10	54	19	23	5		(45)	(7)	(1)

Table 2. Site locations, habitat types present and sampled, number of steelhead collected and estimated density per 100 feet () at sites on Waddell Creek in July 1994.

Site	Mile >Hwy1	Chan Type	%Hab Avail PL	GL	RN	RF	%Hab Sampl PL	GL	RN	RF	Sample Length	#SHT 0+	1+
1 >Div	0.6	C3	33	45	15	7	63	23	14	-	194′	68 (47)	43 (27)
2 <Alder Camp	1.35	C3	30	50	10	10	58	21	18	3	279	97 (38)	32 (14)
3 Twin Redwoods	1.8	C3	30	55	10	5	57	34	9	-	174	85 (70)	27 (17)
4 Peri-winkle	2.2	C3	35	50	10	5	65	19	10	7	240	147 (77)	31 (14)
5 Pullout <Herbert	2.6	C1	40	26	20	14	53	24	12	12	161	163 (107)	27 (18)
6 Camp Herbert	3.1	C1	30	35	25	10	79	9	12	-	233	83 (38)	52 (24)
7 E Fork > Ford	3.2	C1	25	40	20	15	82	13	6	-	208	47 (27)	58 (41)
8 W Fork	3.3	C3	30	40	20	10	39	43	12	6	197	70 (40)	13 (7)
9 Mill Site	3.9	C3	45	30	15	10	73	24	3	-	275	130 (55)	37 (15)
10 Trib @ Bridge	4.7	C1 C1-1	35	35	20	10	86	14	-	-	174	80 (71)	16 (9)
11 HenryCr Trail	5.25	B1-1	30	25	25	20	70	30	-	-	162	96 (66)	29 (23)
Slippery Falls	5.35												
13 HenryCr >Trail	0.2	F	45	10	25	20	71	29	-	-	70	64 (101)	16 (23)
Totals											2367′	1130	381
												1511	
Mean of 12 Sites			34	37	18	11	66	24	7	2		(61)	(19)

Table 3. Site locations, habitat types present and sampled, number of steelhead and coho collected and estimated density per 100 feet () at sites on Scott Creek in 1988.

Site	Mile >Hwy1	Chan Type	%Hab Avail PL	GL	RN	RF	%Hab Sampl PL	GL	RN	RF	Sample Length	#SHT 0+	#Coho 1+
A Below Diversion	0.7	C3	15	60	20	5	16	56	14	4	672′	629 (126)	65 (14) 12 (2)
1A >Little Creek	2.1	C1	20	55	15	10	39	27	10	24	504	239 (49)	28 (6) 103 (24)
1B > Big Creek	2.25		35	35	25	5	86	14	-	-	113	12 (22)	4 (4) 26 (24)
2 Pullout >Big Cr.	2.55	C3	35	35	25	5	58	14	18	10	176	110 (71)	6 (3) 53 (43)
4 <Swanton Road	3.55	C3	35	45	15	5	50	35	15	-	133	264 (205)	8 (14) 16 (30)
8 Big Cr. Gate	4.9	C3	30	50	15	5	34	66	-	-	189	30 (19)	4 (2) 119 (75)
10A Above House	5.55	C3	30	45	15	10	43	28	14	15	237	40 (21)	12 (6) 5 (4)
11AA > Upper Ford	6.2	C1/ B2	35	40	20	5	30	33	32	6	254	38 (15)	13 (5) 3 (1)
12 Big Cr. Swanton Rd.		C1	20	20	35	25	42	10	11	37	306	234 (91)	27 (11) 21 (8)
12A BC Bridge < Hatchery		B2	15	10	60	15	32	23	11	35	316	68 (37)	14 (8) 13 (4)
12B Upstream of Hatchery		B2	25	15	40	20	35	-	51	14	129	42 (39)	11 (9) -
13 Mill Cr. <Swanton Rd.		C1	45	25	15	15	30	28	42	-	83	21 (27)	- -
13A Mill Cr Wilson House		C1	30	15	30	25	36	9	43	-	180	76 (45)	5 (5) 2 (1)
13B 0.5 mi > House		B2	30	10	35	25	47	10	27	23	243	73 (34)	14 (8) 1 (0.4)
Totals											3535	1876 2087	211 384
Mean of 14 Sites			29	33	26	13	41	25	21	12		(57)	(7) (16)

Table 4. Site locations, habitat types present and sampled, number of steelhead and coho collected and estimated density per 100 feet () at sites on Scott Creek in 1994.

Site	Mile >Hwy1	Chan Type	%Hab Avail PL	GL	RN	RF	%Hab Sampl PL	GL	RN	Sample Length	#SHT 0+	1+	#Coho
A Near Diversion	0.9	C3	25	55	15	5	58	37	4	159′	61 (53)	16 (13)	-
1 <Little Creek	1.9	C1	25	50	15	10	47	53	-	165	59 (44)	30 (21)	5 (3)
Big Creek	2.15												
2 Pullout >Big Cr.	2.55	C3	35	35	25	5	75	22	3	166	83 (60)	32 (21)	2 (1)
3 <Mill Creek	3.05	C3	40	40	15	5	72	24	4	123	79 (70)	30 (25)	-
4 <Swanton Road	3.55	C3	30	50	15	5	38	62	-	147	87 (72)	23 (18)	-
5 Cattle Guard	4.25	C3	45	30	15	10	51	49	-	112	42 (47)	16 (15)	-
7 Pullout <Big Cr. Gate	4.9	C3	30	45	18	7	47	45	8	182	15 (10)	24 (13)	2 (2)
9 0.15 mi > bridge	5.15	C3	15	55	20	10	24	53	23	78	12 (17)	19 (25)	1 (1)
11 Upper Ford	5.85	C1	35	50	10	5	45	34	21	206	24 (12)	17 (8)	5 (3)
11AA 3rd Trail Xing	6.3	C1/B2	25	35	25	15	100	-	-	45	11 (59)	11 (24)	2 (4)
11A 4th Trail Xing	6.5	B2	20	10	55	15	61	29	9	162	85 (67)	35 (23)	-
12 Big Cr. Swanton Rd.		C1	20	20	35	25	54	46	-	101	57 (80)	12 (12)	-
13 Mill Cr. <Swanton Rd.		C1	45	25	15	15	92	18	-	98	76 (82)	17 (18)	-
Totals										1744′	691	282	17
Mean of 13 Sites			30	38	21	10	59	36	6		973 (52)	(18)	(1)

Table 5. Number of sites, amount and type of habitat sampled, number of coho collected and estimated density (per 100 feet) for Gazos, Scott, Waddell and Redwood creeks in 1988, 1992, 1993 and 1994.

Stream and Date		Number of Sites Sampled	Length (feet)	Habitat Pl	Gl	Percent Rn	RF	% Sites w/coho	#	Coho Dens. (/100')
Gazos Creek										
Aug	1992	2	275	44	56	0	0	0	0	0
Jan	1994	4	503	65	22	12	1	50	9	2.2
Scott Creek										
Jul-Sep	1988	14	3535	41	25	21	12	84	384	15.5
Aug-Oct	1992	13	1624	66	30	4	0	46	42	4.3
Jan	1994	11	1554	49	32	19	0	100	376	27.2
Aug	1994	13	1744	59	36	6	0	46	17	1.1
Waddell Creek										
Jun-Aug	1988	8	1817	54	19	23	5	63	19	1.3
Jul-Aug	1992	13	2858	67	31	2	0	38	19	0.6
Oct/Dec	1993	12	1857	38	21	28	14	75	58	3.6
July	1994	12	2367	66	24	7	2	0	0	0
Redwood Creek										
Jun-Sep	1992	4	1032	37	40	5	7	100	426	45.3
Jun-Aug	1993	4	951	48	25	18	9	100	355	46.3
July	1994	7	1287	58	25	12	6	43	24	1.9